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PHYTOTOXICOLOGY 1996 INVESTIGATION:

PEEL GAME FARM

BRAMPTON

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PHYTOTOXICOLOGY 1996 INVESTIGATION:

PEEL GAME FARM

BRAMPTON

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Report No: SDB-068-3511-1996

INTRODUCTION

At the request of the Halton/Peel District Office of MOEE, an investigation of lead concentrations in soil was made on the property of the Peel County Game and Fish Protective Association, hereafter referred to as PCGF. It is located at 10194 Heart Lake Road, P.O. Box 2249, Station B, Brampton, L6T 3S4.

The request arose in response to a letter from Bill Cowie, Councillor for the City of Brampton. His letter was written because of the concerns raised by a local resident. The concern was the possibility of lead migration off the PCGF property onto the lands to the south and east. Lead is used in lead shot for skeet shooting and as bullets in the firing range. The club has existed on the site for nearly fifty years hence there is strong possibility that substantial quantities of lead could have accumulated in the soil on and around the shooting range.

METHODS

A site visit was made on August 30, 1996 by Dr. W.D, McIlveen, Phytotoxicology Section, Standards Development Branch, MOEE. At that time, Bob Calvert, President of the Peel County Game and Fish Protective Association, was present and gave a tour of the property.

The property includes four target ranges. The first is an indoor range in which any emissions would be contained. The second was a bow and arrow range for which there are no environmental concerns. The third was a rifle and handgun shooting range. Although it is technically outdoors, it is surrounded by a roofed shelter over the shooting positions, a high dirt bank on the east and a steep embankment to the west. The targets are set in front of a high bank of soil and wooden beams and there is an extensive set of baffles to prevent bullets being accidentally fired over the targets. Although spent bullets were noted in the vicinity of the targets, the whole range was considered to be very well contained. The possibility of lead migrating from this range was too small to warrant sampling.

The sampling conducted was therefore limited to the fourth (skeet shooting) range. In this case, the shooting range consists of several firing stations facing east (towards Heart Lake Road). There is a medium-sized soil berm at the east edge of the range. This berm, in combination with restricted powder load in the shotgun shell, prevents the shot from reaching Heart Lake Road. The area between the berm and the firing stations had a heavy loading of broken clay pigeons and wadding.

Based on the foregoing site inspection, seven sites were chosen for soil sampling. These sites are listed below and are shown in the attached map. At each site, soil samples were collected using a stainless steel soil corer. Each sample consisted of a composite of cores (minimum of 15) placed in a labelled plastic bag [1]. All sampling was completed in duplicate. Samples were returned to the Phytotoxicology Laboratory for processing.

Summary of sampling sites associated with Peel Game Farm, August 30, 1996	
Site 1	Mowed lawn between and immediately in front of firing stations
Site 2	Weedy area in front of firing stations loaded with broken clay pigeons and wadding
Site 3	Lower half of berm in front of Firing Station 3, covered with grass and weeds
Site 4	Bottom half of berm in front of Firing Stations 4 & 5, covered with grass and weeds
Site 5	SE corner of Game Farm property at Heart Lake Road, weedy area adjacent to marshy area, site probably disturbed during construction of Heart Lake Road
Site 6	Mowed embankment on southwest corner of Bovaird and Naismith Roads but facing and open to gun club
Site 7	Edge of Heart Lake Road right-of-way at northeast corner of Esker Lakes Public School

The soils were air-dried, crushed to pass through a 45 mesh sieve and stored in glass bottles. The samples were forwarded to the Laboratory Services Branch, Ministry of the Environment and Energy for chemical analysis [2] for lead and antimony.

RESULTS

The chemical analysis results are shown in the following table.

Lead and antimony concentrations* in soil at Peel Game Farm, August, 1996

Site	Location	Lead	Antimony
1	Lawn between and in front of firing stations	87	2.5
2	Area in front of firing stations	175	3.9
3	Bottom half of berm in front of Firing Station 3	360	4.3
4	Bottom half of berm in front of Firing Stations 4 & 5	180	1.9
5	SE corner of Game Farm property at Heart Lake Road	42	1.1
6	Southwest corner of Bovaird and Naismith Roads	19	0.5
7	Heart Lake Road at Esker Lakes Public School	20	0.4
	OTR_{98} Guideline for Old Urban Parkland	98	0.4
	MOEE Soil Clean-up Criteria - Residential/parkland	200	13.0

* Values shown are means of duplicate samples reported as μg/g dry weight
Values in shaded cells exceed the OTR_{98} guideline for old urban parkland [3] See Appendix I.

The results indicate that both lead and antimony had accumulated in soil associated with the firing range. The OTR_{98} guideline for lead was exceeded only at Sites 2, 3 and 4 which are immediately down range of the firing stations. All of the stations except Site 7 had antimony at concentrations that exceeded the OTR_{98} guideline for antimony. It is concluded that the area has a naturally elevated level of antimony in the soil. The pattern of elevated antimony, which is similar to that of lead, suggests that the firing range had contributed to the antimony levels in soil.

The Clean-up Criterion for lead was exceeded at Site 3. Appendix II is a soil lead information sheet. Although the antimony OTR_{98} was exceeded at six of seven sample sites, the Clean-up Criterion for antimony was not exceeded. The MOEE Soil Clean-up Criteria are effects-based guidelines. Exceedence of these criteria does not imply an automatic clean-up, rather they are intended to guide the decommissioning of industrial/commercial property being redeveloped for residential or parkland use.

SUMMARY

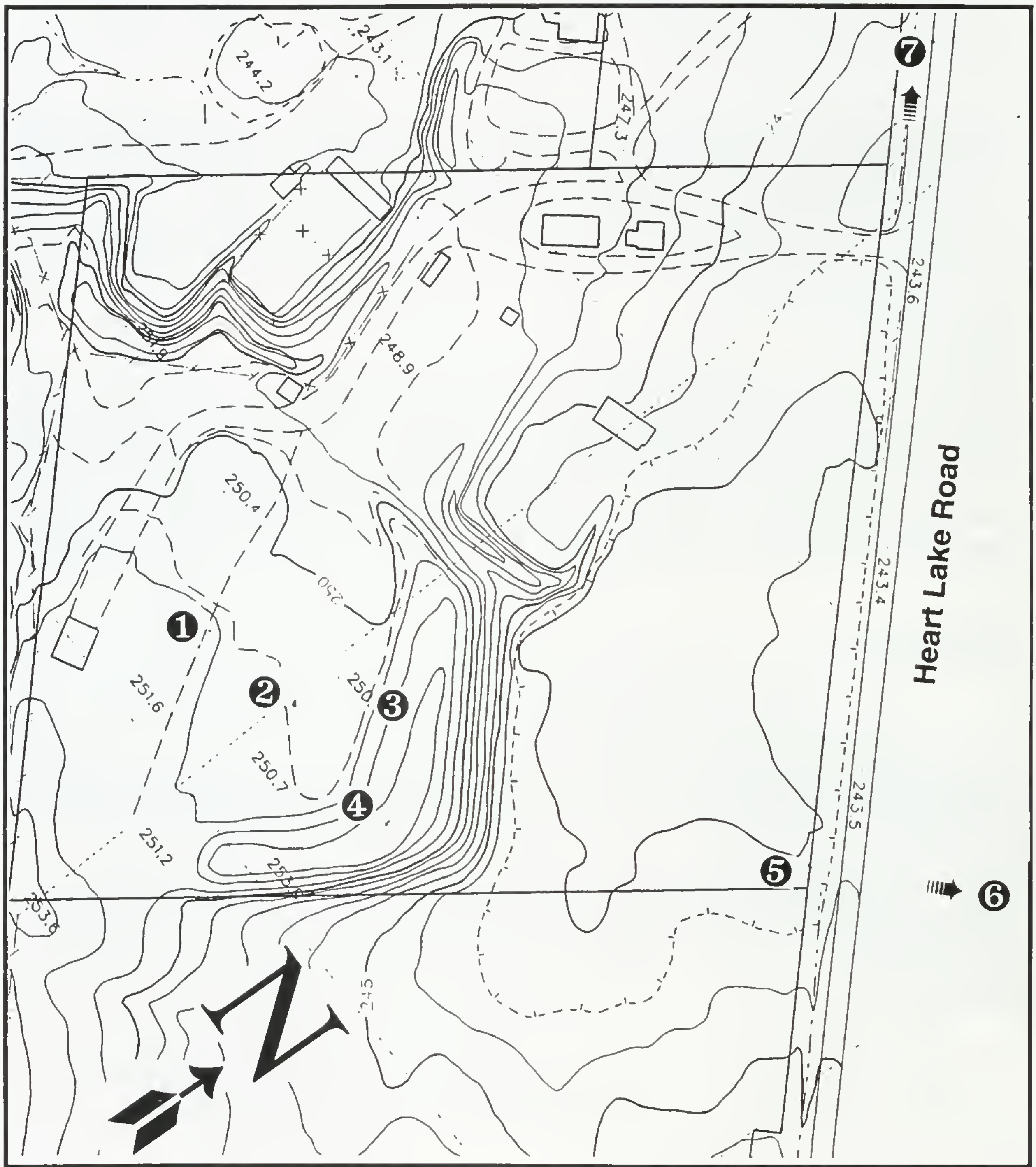
The study indicated that elevated lead and antimony had accumulated in soil associated with and immediately adjacent to the firing range. The lead levels at Site 5 were substantially below the OTR_{98} guideline. This indicates that the potential for lead to migrate off the property is very limited and satisfactorily answers the original question which prompted the survey. Nevertheless, because the MOEE Clean-up Criterion for lead was exceeded at one site, additional sampling should be undertaken in the event that the property is sold or converted to other uses in the future.

REFERENCES

1. McIlveen, W.D., and D.L. McLaughlin. 1993. Field investigation manual Part 1: General methodology. Report No. HCB-014-3511-93.

2. McIlveen, W.D., and D.L. McLaughlin. 1993. Field investigation manual Part 2A: General methodology. Report No. HCB-015-3511-93.

3. Ontario Ministry of the Environment and Energy. 1993. Ontario Typical Range of chemical parameters in soil, vegetation, moss bags and snow. Report No. HCB-151-3512-93.



Map showing sampling locations at Peel Game Farm, August 30, 1996

APPENDIX I

Derivation and Significance of the Ontario Ministry of Environment and Energy (MOEE) "Ontario Typical Range" of Chemical Parameters in Soil, Vegetation, Moss bags and Snow

The MOEE "Ontario Typical Range" (OTR) guidelines are being developed to assist in interpreting analytical data and evaluating source-related impacts on the terrestrial environment. The OTRs are used to determine if the level of a chemical parameter in soil, plants, moss bags, or snow is significantly greater than the normal background range. An exceedence of the OTR$_{98}$ (*the OTR$_{98}$ is the actual guideline number*) may indicate the presence of a potential point source of contamination.

The OTR$_{98}$ represents the expected range of concentrations of chemical parameters in surface soil, plants, moss bags, and snow from areas in Ontario not subjected to the influence of known point sources of pollution. The OTR$_{98}$ represents 97.5 percent of the data in the OTR distribution. This is equivalent to the mean plus two standard deviations, which is similar to the previous MOEE "Upper Limit of Normal" (ULN) guidelines. In other words, 98 out of every 100 background samples should be lower than the OTR$_{98}$.

The OTR$_{98}$ may vary between land use categories even in the absence of a point source of pollution because of natural variation and the amount and type of human activity, both past and present. Therefore, OTRs are being developed for several land use categories. The three main land use categories are Rural, New Urban, and Old Urban. Urban is defined as an area that has municipal water and sewage services. Old Urban is any area that has been developed as an urban area for more than 40 years. Rural is all other areas. These major land use categories are further broken into three subcategories; Parkland (which includes greenbelts and woodlands), Residential, and Industrial (which includes heavy industry, commercial properties such as malls, and transportation rights-of-way). Rural also includes an Agricultural category.

The OTR guidelines apply only to samples collected using standard MOEE sampling, sample preparation, and analytical protocols. Because the background data were collected in Ontario, the OTRs represent Ontario environmental conditions.

The OTRs are not the only means by which results are interpreted. Data interpretation should involve reviewing results from control samples, examining all the survey data for evidence of a pattern of contamination relative to the suspected source, and where available, comparison with effects-based guidelines. The OTRs are particularly useful where there is uncertainty regarding local background concentrations and/or insufficient samples were collected to determine a contamination gradient. OTRs are also used to determine where in the anticipated range a result falls. This can identify a potential concern even when a result falls within the guideline. For example, if all of the results from a survey are close to the OTR$_{98}$ this could indicate that the local environment has been contaminated above the *anticipated average,* and therefore the pollution source should be more closely monitored.

The OTRs identify a range of chemical parameters resulting from natural variation and normal human activity. ***As a result, it must be stressed that values falling within a specific OTR$_{98}$ should not be considered as acceptable or desirable levels; nor does the OTR$_{98}$ imply toxicity to plants, animals or humans.*** Rather, the OTR$_{98}$ is a level which, if exceeded, prompts further investigation on a case by case basis to determine the significance, if any, of the above normal concentration. Incidental, isolated or spurious exceedences of an OTR$_{98}$ do not necessarily indicate a need for regulatory or abatement activity. However, repeated and/or extensive exceedences of an OTR$_{98}$ that appears to be related to a potential pollution source does indicate the need for a thorough evaluation of the regulatory or abatement program.

The OTR$_{98}$ supersedes the Phytotoxicology ULN guideline. The OTR program is on-going. The number of OTRs will be continuously updated as sampling is completed for the various land use categories and sample types.

Ministry of Environment and Energy

FOR YOUR information

NOVEMBER 1995

Frequently asked questions about lead in soil

WHAT IS LEAD?

Lead is a toxic heavy metal that is released into the environment through industrial sources, the previous use of leaded gasoline (now banned), disposal of lead wastes and the peeling or flaking of lead-based paint. Ontario residents are exposed every day to varying amounts of lead. Only about one per cent of our daily exposure to lead is from natural sources.

HOW MUCH LEAD IS THERE IN OUR SOIL?

Lead in surface soil in residential communities is often higher than 200 parts per million (ppm). In older, larger urban residential areas like Toronto, lead in soil may exceed 500 ppm, even when there is no local industrial source. Lead in soil in smaller communities is usually below 100 ppm.

IS LEAD HARMFUL?

Young children (aged six months to four years) are most at risk from lead exposure. Children take in an average of 80 milligrams of soils and dust (a volume of soil about the size of a grain of rice) each day while they play and, depending on the concentration of lead in soil, may develop high levels of lead in their blood.

In addition to direct exposure to soil, lead-contaminated soil contributes to the levels of lead found in dust within the home. Lead-based paints and industrial pollution can also contribute to lead dust in the home. Soil and dust are considered to be the major routes of exposure to lead for children.

The Ministry of Environment and Energy advises that there is minimal risk from exposure to soil with lead levels below 200 ppm.

HOW ARE CHILDREN AFFECTED?

High levels of lead in children may result in reduced hearing, muscle co-ordination and intellectual development. Lead contamination may also contribute either to lethargy or to aggressive behaviour.

If you have concerns and would like more information, contact your local office of the Department of Public Health or your medical doctor.

CAN I EAT VEGETABLES FROM MY GARDEN?

Lead enters and is stored in vegetables grown in lead-contaminated garden soils. The amount of lead taken up and stored in these vegetables will vary depending on the type of vegetable, the type of soil, your gardening practices and the amount of lead in the soil.

Although lead normally increases in plants as they age, lead is taken up and stored differently in roots and in plant leaves. For example, lettuce leaves can store seven times more lead than the roots of carrots. Beet leaves contain more lead than beet roots. Therefore, it is not always safe to assume that root vegetables will contain more lead than leafy vegetables. Fruit crops such as tomatoes, berries, apples an cucumbers, present a much lower risk because they take up and store very little lead.

For most people, there is minimal risk in consuming home-grown vegetables at soil lead levels below 200 ppm. However, this is only a guide and it should be remembered that eating vegetables grown in soil contaminated with lead will always increase your exposure to lead and the risk to your health, especially for young children.

WHAT CAN I DO TO REDUCE EXPOSURE TO LEAD?

- Keep your children away from soil contaminated with lead. Contaminated soil can be removed, or exposure can be reduced by covering the soil with clean soil or sod. Soil can also be paved over or covered with paving stones or decking.
- Wash children's hands and faces after playing outdoors and before eating.
- Clean your home regularly using a damp mop or damp cloth. Vacuuming and sweeping can increase dust levels in the home. Use a phosphate cleaner at least once a week, especially near window sills and doors. Use rugs, curtains and slipcovers that can be cleaned easily.
- Have forced air ducts cleaned by professionals and replace furnace filters often.
- Avoid bringing outdoor dirt inside by removing outdoor shoes.
- Brush pets often as their fur collects dust. Pet should be brushed outside if possible.
- Keep children's toys and play areas clean; discourage mouthing activities such as eating dirt.
- Don't let your children eat paint chips. They like them because the lead in the paint makes the chip taste sweet.
- Locate your vegetable garden at least one metre (three to four feet) away from roads, driveways and down spouts. Also make sure your garden is at least a metre away from sources of flaking paint such as walls, sheds and fences.
- Before eating, wash all vegetables thoroughly and peel skin from root crops.
- If your soil is contaminated with lead, don't feed garden vegetables to young children or use them in baby food recipes.

HOW CAN I GET MORE INFORMATION?

If you live in the vicinity of a source of lead pollution and you suspect your soil may be contaminated, contact your local office of the Ministry of Environment and Energy.

Contact your local office of the Department of Public Health or your medical doctor if you are concerned about being exposed to lead or have questions about health effects.